EXPLANATION OF PLATE 145.

Coleus plant parasitized by *Orobanche ramosa* L. FIG. 1, *Coleus* plant; figs. 2, 3, and 4, very small *Orobanche* plants attached to *Coleus* roots; fig. 5, a small flowering plant of *Orobanche*; fig. 6, a larger detached *Orobanche* plant not fully developed. Natural size.—Photo by W. R. Fisher.

EXTENSIONS OF RANGE AND A NEW VARIETY IN SALIX.

CARLETON R. BALL.

OUR knowledge of the distribution of species, and of their numerous variations increases steadily. Amateur, subprofessional and professional botanists all have contributed largely to this result. The writer has been most fortunate in having had opportunity to study and identify many of the willow collections from all classes of botanists in the United States and Canada. This has given rise to a series of papers[1] describing new species and varieties, and recording extensions of range.

In the third[2] of these papers the willows of the Black Hills of South Dakota were discussed chiefly in the light of recent collections made by John Murdoch, Jr., T. C. Setzer, and N. E. Petersen, of the U. S. Forest Service. Of the 12 species listed, the one recorded as *S. fluviatilis* Nutt. is *S. interior* Rowlee, the Nuttall plant being confined to the lower Columbia River.[3]

In addition to the 12 species recorded for the Black Hills district, *cordata* occurs in the eastern portion of the State. To these 13 species, the present paper adds to the known flora of South Dakota 3 species, *missouriensis*, *petiolaris* and *candida*, and a new variety of *discolor*. This makes a total of 16 species of Salix recorded for the State.

[1] Ball, Carleton R. Notes on North American Willows I–III. Bot. Gaz. **40:** 376–380, pls. 12–13, 1905; ibid. **60:** 45–54, figs. 3, 1915; and ibid **60:** 391–399, 1915, respectively.

————Undescribed Willows of the Section Cordatae. Bot. Gaz. **71:** 426–437, fig. 1, 1921.

————Notes on Willows of the Sections Pentandrae and Nigrae. Bot. Gaz. **72:** 220–236, figs. 1–4, 1921.

————and Kirk Whited. Pruinose Branchlets and Salix lemmoni Bebb. Am. Jour. Bot. (in press). 1923.

[2] Bot. Gaz. **60:** 391–399, 1915.

[3] Ball, Carleton R. Notes on North American Willows II. Bot. Gaz. **60:** 52–54, 1915.

A NEW VARIETY OF SALIX DISCOLOR FROM SOUTH DAKOTA.

At the juncture of Minnesota, South Dakota, and North Dakota is a district very interesting geologically and botanically. It was once the scene of great glacial activity. In general, it lies between the Dakota and Minnesota lobes of the Wisconsin glaciation.

Topographically this district may be separated into 3 fairly distinct parts, namely, (1) the trough, occupied by Big Stone and Traverse Lakes, which lies on the boundary line between Minnesota and the Dakotas, at an elevation of about 1,000 feet above sea level; (2) the gently sloping plain which lies directly west of the trough and reaches an elevation of 1200 to 1300 feet on its western edge, and (3) the rough and dissected morainal hills which extend north and south, forming the western boundary of the plain some 10–15 miles west of the lakes, and extending a little way into North Dakota. These hills, known as the Sisseton Hills, probably reach an elevation of nearly or quite 2,000 feet at the highest points. Beyond these hills, the higher plains stretch away to the westward.

This district is made interesting also by another topographic fact. Big Stone and Traverse Lakes lie end to end in a curved glacial valley. They are separated only by a low ridge or moraine a few miles wide lying transversely across the valley floor. In spite of this proximity and slight separation, however, they belong to entirely different drainage systems.

Big Stone Lake drains through the Minnesota River to the Mississippi and thence to the Gulf of Mexico and the Atlantic. Traverse Lake is drained by the Red River of the North to Lake Winnipeg and thence to the Arctic.

From these facts it follows that these lakes lie on the "Height of Land" of the old geographies, which separates the Arctic and Mississippi drainage basins. Furthermore, they are about 300 miles south of the Canadian line. As the Missouri River enters North Dakota far to the northwest and not far from the Canadian line, and as the Mississippi River rises far to the northeast in Minnesota it is seen that Traverse Lake occupies the southern apex of a triangle of Arctic drainage projecting far south into Mississippi Basin drainage.

The Red River has its source in Traverse Lake but the Minnesota River does not rise in Big Stone Lake. Its sources are 10 to 15 miles northwestward in the Sisseton Hills, previously described. The abrupt eastern face of this low range is cut by numerous deep,

rocky, timbered coulees or cañons, which contain the headwaters of the Minnesota River.

Through the courtesy of Prof. W. H. Over, of the University of South Dakota, the writer was privileged to join a party from that institution which was collecting in this district in the summer of 1923. Though it was possible to remain for only three days, the trip was well repaid.

The flora of the wooded eastern escarpment of the Sisseton Hills, and of the deep rocky coulees that issue from it, is largely an eastern flora. Among the plants are the sugar maple, bur oak, American and beaked hazelnuts, blue cohosh, and many others.

The willows of this district are no less interesting than the other plants. The abundant occurrence here of *S. missouriensis* Bebb, far to the north of its previously accepted range, is discussed elsewhere in this paper. There seems to be a general tendency toward the production of broad-leaved forms. These were collected in the glacial trough occupied by Big Stone and Traverse Lakes, and also in the coulees of the Sisseton Hills, but not in the plain between. Such amplification of the foliar organs was found in four out of seven species collected. No specially large-leaved plants of *S. interior* Rowlee, *S. cordata* Muhl., or *S. missouriensis* were noted.

One plant (*Ball* 2214) of *S. amygdaloides* And., in a group of several plants on the ridge between the lakes, had ovate leaves, a form collected previously by the writer at Cottonwood, South Dakota, west of the Missouri River. One plant of *S. lutea* Nutt. (*Ball & Over* 2232), out of several seen in a coulee in the Sisseton Hills, had ovate leaves very suggestive of *S. lutea platyphylla* Ball from the Wahsatch and Great Basin sections. Of *S. bebbiana* Sarg., only a single plant was seen, in a coulee, but it (*Ball & Over* 2230) has rather large obovate-oval leaves, quite different in shape from those of the normal plant of this species. Finally, a very broad-leaved form of *discolor* is here described as a new variety.

SALIX DISCOLOR **overi** Ball n. var. Tree up to 8 inches in diameter and 15–20 feet tall; branchlets short and divaricate, the bark dark brown, reddish brown or sometimes yellowish, not shining, glabrous or the most recent growth slightly puberulent, usually wrinkled longitudinally; stipules none or, on sprouts, 2–7 mm. long, subreniform to semicordate, acute denticulate, often deciduous; leaves broadly elliptical to oval or broadly obovate, on flowering or fruiting branches mostly obovate, subremotely and coarsely or shallowly crenate-serrate

commonly 2.5 × 4, 3–3.5 × 5–6, 4 × 7–8, and 4.5 × 7 cm., or on sprouts 3 × 8, 4 × 10, and 5.5–6 × 11–12 cm., acute or subcuneate at base, short-acuminate from an acute apex or cuspidate from a broadly acute to obtuse apex, dark green above, subglaucous to glaucous beneath, the yellowish-brown midrib and slender lateral veins plane or slightly elevated above, rather strongly elevated beneath, glabrous throughout, or thinly pubescent with shining hairs while unfolding.

Pistillate aments subsessile, with 1–3 small bract-like leaves at base, 5–6 cm. long; mature capsule conic-rostrate, 9–11 mm. long; pedicels 1–2 mm. long; style nearly or quite 1 mm. long; stigmas divided, 0.5 mm. long.

Variety *overi* is distinguished from the typical form of the species chiefly by the larger, obovate or broadly oval leaves and perhaps by longer styles also, though the paucity of material makes this uncertain.

A study of 121 sheets of *S. discolor* Muhl. in the herbarium of the writer and of 135 specimens in the U. S. National Herbarium fails to discover any other collections which are referable to this variety. Several sterile specimens collected by the writer in the southern parts of Vermont and New Hampshire approach it somewhat in the shape and size of the leaves. The following specimens represent this variety:

SOUTH DAKOTA: Roberts Co., west shore of Big Stone Lake, at Hiawatha Beach, *W. H. Over* 14483, Aug. 12, 1922 (fol.), May 21, 1923 (fruit); *C. R. Ball & W. H. Over* 2238, Aug. 9, 1923 (fol.), (both numbers from same plant and therefore type specimens). Traverse Lake, inside wire fence below the spring on Sisseton road, 2 miles northwest of Brown's Valley, Minn., *C. R. Ball & W. H. Over* 2249, Aug. 10, 1923 (foliage and old staminate aments).[1]

The type tree is in an old channel on the left (west) of the road at Hiawatha Beach, just before it turns west to Art Lake's house, which stands several rods farther west. It consists of an old prostrate trunk about 8 inches in diameter, partly buried in the mud, and bearing stout branches about 4 inches in diameter, rooted at the base, and reaching a height of 12–15 feet.

Salix discolor (*Ball & Over* 2236, 2237) was abundant in the swampy ground nearby and one plant of *S. missouriensis* Bebb was nearby

[1] *Over* No. 14483 is in herbaria Ball and Univ. So. Dak.; *Ball & Over* Nos. 2238 and 2249 have been deposited in herbaria Ball, Can. Geol. Surv., Cornell Univ., Field Museum, Gray, Ia State Coll., Minn. Univ., Mo. Bot. Gard., Rocky Mt. (Wyo.), So. Dak. Univ., and U. S. Nat. No. 2238 has been placed also in the herbaria of Calif. Acad. Sci., N. Y. Bot. Gard , No. Dak. Agric. Coll., So. Dak. Agric. Coll., and Stanford Univ.

(*Ball & Over* 2240). *Cornus stolonifera* Michx. was common in the immediate vicinity, as were also such grasses as *Agrostis palustris* Huds., *Poa palustris* L., and *Panicularia nervata* (Willd.) Ktze.

Salix missouriensis in South Dakota.

Salix missouriensis Bebb[1] was first described by Andersson as *S. cordata vestita* from a specimen collected by the Duke of Neuwied near Fort Osage on the Missouri River. The recent manuals of botany do not give it an extensive range. Gray's New Manual[2] says "Mo. to Nebr. and I. T.," while Britton and Brown,[3] and Britton[4] say "Mo. and Nebr." The writer[5] in 1899 recorded its occurrence in eastern Iowa, near Muscatine and Davenport, and at Sioux City in Northwestern Iowa.

Material in various herbaria shows the species to be distributed in Missouri and the eastern parts of Kansas and Nebraska, and along the Missouri River in Iowa as far as Sioux City. Typical material collected by E. J. Palmer in extreme southern Illinois is in the National and Arnold Arboretum herbaria. Sterile specimens from Jo Daviess County in northwestern Illinois almost certainly belong here. Sioux City, Iowa, has been the northwestern limit of its recorded range.

In 1922 and 1923, Prof. W. H. Over, of the University of South Dakota, collected willows in the southeastern part (Clay Co.) and in the northeastern part (Grant, Day, and Roberts Cos.) of the State, and sent them to the writer for identification. Inspection of this material, mostly foliage specimens, showed that it represented *missouriensis* rather than *cordata*, though it was far to the north of the accepted range of *missouriensis*.

Early in August, 1923, the writer had the opportunity to join Professor Over for a short time in an exploration of the eastern portion of Roberts County, South Dakota. A study was made of the willows (1) along the west shore of Big Stone Lake, (2) near the south end of Lake Traverse, and (3) in the coulees of the Sisseton Hills, some 5 miles west of Sisseton, the county seat of Roberts County. Here the most abundant species of the *cordata* group was *S. missouriensis*, previously collected in Roberts County in 1922 by Professor Over.

[1] Andersson, N. J. Kongl. Vet.-Akad. Handl. **6:** (Monog. Sal.) 159, 1867.
[2] Robinson, B. L., and M. L. Fernald. Gray's New Manual Bot. 323. 1908.
[3] Britton, N. L., and Addison Brown. Illus. Flora **1:** 503, 1896.
[4] Britton, N. L., Man. Bot. 314–315, 1901.
[5] Ball, Carleton R. The Willows of Iowa. Proc. Ia. Acad. Sci. **7:** 153, pl. 12, 1900

Along the parts of Big Stone and Traverse Lakes visited, *S. missouriensis* was practically the only species of the *cordata* group present. A single plant of *cordata* was found at a large spring beside the Sisseton road about 2 miles northwest of Brown's Valley, Minn., and near the south end of Lake Traverse. In the coulees of the Sisseton Hills, however, some 12–15 miles to the northwest, at elevations several hundred feet higher, *S. missouriensis* was associated with *S. lutea* Nutt., the latter species being fairly common there.

Salix missouriensis Bebb differs from *S. cordata* Muhl. chiefly in the larger size, the more densely pubescent or tomentose one-year branchlets, the densely tomentose or pilose bud-scales, pubescent petioles, and the usually larger leaves, more distinctly glaucous underneath, with midveins pubescent in the basal portion of the leaf both above and below. The furry bud-scales are especially striking at nearly all seasons of the year. A dense coma occurs at the base of the aments and newly developing vegetative shoots. It is composed of long white hairs from 2 to 4 mm. long. This coma seems to be longer and much more abundant than in *S. cordata* and often is quite prominent on young growth. The aments on the only fruiting specimen (*Over* 14482A of 1923) apparently have been injured by frost and are of little diagnostic value.

The following South Dakota specimens in the herbarium of the writer are referred to *S. missouriensis*. Most if not all of these also are in the herbarium of the University of South Dakota at Vermillion, and those collected by Ball and Over are being distributed to several herbaria.

Clay Co., Vermillion, *Over* 13830, Oct. 12, 1922; Grant Co., Southshore, *Over* 15447, July 17, 1923; Day Co., sandy shore of Dry Woods Lake, *Over* 14479, July 5, 1922; Roberts Co., flood plain of Spring Creek, Hartford Beach, Big Stone Lake, Over 14482A, July 17, 1922, May 21, 1923; *Ball & Over* 2246, Aug. 9, 1923; Hiawatha Beach, Big Stone Lake, *Ball & Over* 2240, Aug. 9, 1923; deep rocky coulee 5 miles west of Sisseton, *Ball & Over* 2233, Aug. 8, 1923; shallow coulee in prairie 3 miles west of Sisseton, *Ball & Over* 2235, Aug. 8, 1923.

In July, 1923, a native willow was found in cultivation on the Dickinson Substation, Dickinson, No. Dak., in the west-central part of the State. It proved to be *S. missouriensis* Bebb, but the origin of the original cuttings is not known. A similar plant cultivated on the Northern Great Plains Field Station, Mandan, No. Dak., probably

is *missouriensis* also, and equally probably came from the nearby Missouri River at Bismarck.

Local collectors in the Dakotas and adjacent Minnesota can do much to determine the range of this and other species of equally doubtful distribution.

Salix petiolaris in the Dakotas.

Salix petiolaris J. E. Smith is another species of which the western limits of range are but little known. Recent manuals of botany give the western limit in the United States variously as "Wisc.," "Great Lakes," "Ill.," and "S. D.," and its range in Canada variously as "N. W. Ter.," "Man.," and "Sask." The South Dakota reference is given by Rydberg[1] but upon what authority is not known to the writer. MacMillan[2] states that it occurs in the "N. E. and S. E. district" of the Minnesota Valley, which would confine it to the eastern portion of southern Minnesota.

In Iowa, *petiolaris* occurs across the northeastern third, as far west as Webster and Emmet (*Cratty*) Counties.

Salix petiolaris is widely distributed in Minnesota, as recent collections indicate. In the herbarium of the writer are specimens from Anoka (*Metcalf* 1325), Stearns (*Over* 15442), and Chippewa (*Moyer* 401) Counties, which show a range practically across the State from east to west just north of Minneapolis and one-third of the way from the southern boundary to the Canadian line. It also contains 4 specimens from the vicinity of Cass Lake, Cass County (*Pammel et al* 14, 502, 583, 589), in the north-central part.

In North Dakota, the writer's herbarium shows specimens from Hankinson, Richland County (*V. Bailey*), Lake George, McHenry County (*Mabbott* 417), and Birchwood in the Turtle Mountains of Rolette County (*V. Bailey*). In the National Herbarium there are specimens also from Butte, Benson County (*Lunell*), and Underwood, McLean County (*Metcalf* 413).

If a straight line be drawn from Webster County, Iowa, the most southwestern station for *petiolaris* in the State, northwest to McLean County, in central North Dakota, most southwestern outpost of the species in that State, the line will pass at some distance to the south west of Chippewa County, Minnesota, and Richland County, North

[1] Rydberg, Per Axel. Flora of the Rocky Mountains and adjacent Plains 195. 1917.

[2] MacMillan, Conway. The Metaspermae of the Minnesota Valley. Geol. & Nat. Hist. Surv. Rept. Bot. Ser. **1**: 183. 1892.

Dakota, other southwestern points in its known range, and will cut off several counties in northeastern South Dakota. It is something of a happy coincidence, therefore, that on May 23, 1923, Prof. W. H. Over, should have collected an undoubted specimen of this species near a spring, east of Bitter Lake, Day County, South Dakota (*Over* 15374, in herbaria C. R. Ball and University of South Dakota). Day County is the second county from the northeast corner of South Dakota and just south of Marshall County where *S. candida* was found. Both contain many glacial lakes.

SALIX CANDIDA NEW TO SOUTH DAKOTA.

Salix candida Fluegge is found in cold bogs from Newfoundland, New England and New Jersey westward to the Rocky Mountains of Colorado, Wyoming, and Montana and Alberta, and the mountains of British Columbia. The southern boundary of its range is found in the glacial bogs of the northern portions of Ohio, Indiana, Illinois and north central Iowa. From there the western line of its prairie distribution bent sharply far to the northward, the next stations previously known to the northward being at Butte in Benson Co. and Underwood in McLean Co., both in central North Dakota, in the glaciated area east of the Missouri River.

In 1923, however, it was collected in "marshy places at the northeast corner of Buffalo Lake, Marshall Co." So. Dak., by Prof. W. H. Over, No. 15438, on Aug. 3. The plant apparently was growing luxuriantly and has unusually broad leaves. The material is deposited in herb. Univ. So. Dak., Nat. Herb. and that of the writer. Marshall Co. is in the northeastern portion of the State, lying against the North Dakota line just west of Roberts Co., discussed previously in this paper. This collection extends the known range considerably to the southwest. The species may be looked for about the margins of the numerous other swampy lakes in northeastern South Dakota and adjacent North Dakota.

SALIX CANDIDA DENUDATA ANDERSSON.

Andersson[1] erected the variety *denudata* of *Salix candida* in 1868 but it has not been recognized in manuals of botany until recently. Andersson cited no collections or localities. Robinson and Fernald[2] give the range as "Gaspé Co., Que., to Wisc. and Ct."

[1] Andersson, N. J., in De Candolle Prodromus Syst. 16[2]: 278, 1868.
[2] Robinson and Fernald, Gray New Man. Bot. 327, 1908.

The variety differs from the species in having narrower leaves, glabrate or glabrescent on both sides, especially above, and sometimes glaucescent beneath.

In his discussion of *candida* and its variations, Schneider[1] cites specimens of this variety (p. 228) from Newfoundland, Quebec, Ontario, New Jersey, New York, and Wisconsin. To this distribution now should be added Connecticut, as stated by Robinson and Fernald, and perhaps Indiana.

The specimens seen by the writer and their locations are listed below. CONNECTICUT: Open places in swamp, Salisbury, *C. A. Weatherby* 3634, June 6, 1915 (Nat. Herb.); Twin Lakes, Canaan, *Chas. A. Davis* 3 (in part), June 1, 1912 (herb. C. R. B.). Of three full sheets of the Davis collection only one bears material of this variety. NEW YORK: 3–6 dm. high, in water, "Fiddlers Glen," Pecksport, *W. R. Maxon* 6206, June 9, 1916 (herb. C. R. B.).

The Indiana plant was collected "in a willow bog on the south side of Pigeon River, 1¼ miles east of Mongo, Lagrange Co.," *Chas. C. Deam* 30458, May 27, 1920. Mr. Deam, the State forester, notes concerning this plant "Closely associated with *S. bebbiana, S. candida, S. petiolaris*, and other species of Salix. Only two specimens found. In habit and size resembles *S. candida* and grew with it." The developing leaves are linear, strongly involute, and glabrous, even to part of those just unfolding. In the numerous aments, the capsules also are entirely glabrous and almost all have remained unfertilized. This indicates, though it does not prove, a hybrid origin. The styles are usually long and slender, and deeply divided.

SALIX PELLITA ANDERSSON IN MICHIGAN.

For many years this species was misinterpreted by American botanists, as Fernald[2] so excellently has shown. The only locality in the United States mentioned by Fernald was "northern Maine" to "the lower Androscoggin River, Maine." Schneider,[3] in discussing this species, gives its distribution as follows (p. 83):

"I have seen forms which I refer to *S. pellita* from southern Labrador

[1] Schneider, Camillo. Notes on North American Willows VIII. Jour. Arnold Arb. **1**: 211–232, 1920.

[2] Fernald, M. L. The identity of Andersson's *Salix pellita*. RHODORA **6**: 191. Sept., 1904.

[3] Schneider, Camillo. Notes on American Willows—VI. Journ. Arnold Arboretum **1**: 67-97. (Oct.) Nov. 20, 1919.

(*Fernald & Wiegand*, No. 3182, st.; G., O.; forma quamvis incerta, porro observanda), western Newfoundland, New Brunswick (as far north as Woodstock in Carleton County), Maine (Aroostook and Somerset Counties), Vermont (Bloomfield in Essex County), and westward from Quebec (as far north as Lake St. John), Michigan (Isle Royale, Houghton County), Ontario (Savanne, Thunder Bay County), and the Lake Winnipeg region."

Isle Royale, mentioned above, is the only station recorded by Schneider for this species in the United States west of New England. It is an island in the northern part of Lake Superior, in longitude 89° and latitude 48°, near the mainland at the Ontario-Minnesota boundary. The collection (a pruinose sterile twig, in Gray Herbarium) was made by Wm. S. Cooper (No. 6) on July 22, 1909. To this Michigan locality may now be added another, in the Upper Peninsula and about 200 miles southeast of Isle Royale. The new locality is the swampy valley of the Tahquamenon River in Luce County. A specimen collected by Chas. K. Dodge, identified by the writer, and now at the University of Michigan, is labeled "abundant, low marshy banks of the Tahquamanan River, Luce Co., Sept. 9, 1915." A second specimen was collected there by Franklin P. Metcalf (No. 2301), on the Tahquamenon River near Newberry, Luce Co., Sept. 15, 1922. Mr. Metcalf, a botanist of the Bureau of Biological Survey, U. S. Department of Agriculture, states that the area where his collections were made is a swampy stretch of land about 3 miles in diameter, through which the river meanders. It is located some 8 miles on an airline or about 15 miles by water down the river from the town of Newberry and is surrounded by higher land bearing timber. The locality is known locally as "Dead Man's Farm," because of a deserted farm on the nearby ridge. The chief vegetation of this swampy area consists of *Carex spp.*, *Scirpus cyperinus* and *Phalaris arundinacea*, all abundant, *Cornus stolonifera* and *Polygonum* spp., both common, and at least three species of *Salix*, namely, *lucida*, which was abundant, and *petiolaris* and *pellita*, both of which were common. His specimens will be placed in the National Herbarium.

The two specimens, both sterile, collected by Dodge and Metcalf, are almost identical in appearance, with pruinose twigs and narrowly lanceolate leaves about 1.2–1.4 × 8–10 or 1.5 × 7 cm. in size and showing no sign of becoming glabrate beneath, though collected late in the season.

BUREAU OF PLANT INDUSTRY, Washington, D. C.